DA INTELLIGENCE REPORT
(Use this form only in accordance with instructions [redacted])

CLASSIFICATION: ~~CONFIDENTIAL~~

COUNTRY REPORTED ON: [redacted] Germany

DATE OF REPORT: 19 Sept 58

SUBJECT: Tunnel Borer for the East German Army (C)

Of Information: Described in this report is an electrically-driven, hydraulically-operated tunnel borer. With its two contrarotating rotary cutting heads, a tunnel 2 m in height and 1.5 m in width can be driven under continously equal cut. Operational tests showed that a tunnel from 1.5 to 1.8 m in length, complete with shoring, can be driven into medium hard earth formation in an hour. Spoiling is disposed of by a baffle-type chain conveyor which is an integral part

CLASSIFICATION

DA FORM 1 OCT 53 1048 REPLACES OCS FORM 17A, 1 APR 53, WHICH MAY BE USED.
CAUTION — REMOVE PROTECTOR SHEET BEFORE TYPING.

A - P
B - Ly, Circ

DA INTELLIGENCE REPORT
(Use this form only in accordance with instructions in AR 381-25)

CLASSIFICATION: CONFIDEI

PAGE 2a 1a

of the tunnel borer.

The tunnel borer is in production for the EGA at the VEB Bergbau Maschinenfabrik in SEEHAUSEN. Source was informed that in 1957 five tunnel borers were produced and that in 1958 22 to 25 more are to be produced.

The information in this report is supplemented by five inclosures.

50X1-HUM

50X1-HUM

NOTE: Reproduction of this document in whole or in part is prohibited, if SECRET or TOP SECRET, except with permission of the issuing office. All requests for authority to reproduce will be directed to the Assistant Chief of Staff, Intelligence, Department of the Army.

CLASSIFICATION

NOTE: This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C. 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

DA FORM NOV 57 1048-2 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

Tunnel Borer for the East German Army (C)

COORDINATES

BERNBURG (UTM 32UPC 8942)
SEEHAUSEN (UTM 32UPC 5775)
WERNIGERODE (UTM 32UPC 0307)

REPORT

1. Introduction

The tunnel borer described in this report is electrically driven and hydraulically operated. With its two rotary cutting heads, the tunnel borer makes a continuously equal cut on a tunnel face measuring 1.5 x 2 m in size. It moves forward at 12 to 16 cm per minute. The spoiling is carried out of the tunnel on a baffle-type chain conveyor built in as an integral part of the tunnel borer. See Inclosure 1 for a drawing of the complete tunnel borer.

The tunnel borer can be used to perform a number of tasks of engineer troops. Examples are preparing underground detonation chambers, underground POL and munitions storage chambers; boring tunnels for circumventing enemy troop positions; boring tunnels to rivers or bodies of water for flooding enemy strategic points distant from the river; boring tunnels under river beds for passage from one side of the river to the other.

Based on operational tests made in the vicinity of HALLE, it was found that in an hour a tunnel averaging 1.5 to 1.8 m in length could be driven into medium hard earth formation. Included in the time was time spent in placing temporary and permanent shoring for the ceiling and walls of the tunnel. The cutting or boring was done in stages of 45 to 75 cm length.

The tunnel borer is in production at the VEB Bergbau Maschinenfabrik in SEEHAUSEN. [redacted] in 1957 five tunnel borers were produced for the East German Army, and that an additional 22 to 25 are to be produced in 1958. 50X1-HUM

2. Description of the Tunnel Borer

a. Auger Assembly (Inclosures 1, 2 and 5)

The auger assembly consists of two vertical contrarotating cutting heads which rotate from the outside to the inside toward the middle. The diameter of each rotary cutting head is 75 cm. Each rotary cutting head is supported at two points.

The rotary cutting head blade, divided into a sole, intermediate and head part, is welded onto a tubular drive shaft. The sole part of the rotary cutting head blade thrusts upward, and the intermediate and head parts thrust downward. This arrangement of upward and downward thrusts, together with contrarotation of the rotary cutting heads, provides a flawless clearing of the spoilings and transfer of same onto the conveyor for disposal.

CLASSIFICATION

[redacted] bits along the outer edge of the rotary cutting head blad[redacted] spaced 5 mm apart. The cutting bits have cemented carbide tips welded on as cutting surfaces. The cutting bits are welded onto two pieces of flat steel whence a "U" shape is formed with the cutting bit forming the closed end of the "U". The open end of the "U" is slid over the rotary cutting head blade and is held in place by two screws.

The tubular drive shaft is also in three parts corresponding to the parts of the rotary cutting head blade. Flanges for connecting the gear trains are on the tubular drive shaft at the points between the head and intermediate parts and the intermediate and sole parts.

Mounted on the gear trains are small cutting heads for cutting those parts of the tunnel face not reachable by the two rotary cutting heads' blades due to the interfering gear train supports.

A slightly arched steel plate, which prevents the tunnel ceiling from falling in when the tunnel borer is stationary, is fastened to the top of the auger assembly over the two rotary cutting heads.

b. Back Cover, Supporting Framework, and Auger Assembly Gearing

(1) Back Cover (Inclosure 2)

The purpose of the back cover is to shield the tunnel face and, together with the cut tunnel face, to form a tubular transport chute for the auger. The back cover serves also a protection against the centrifuged spoilings in the auger assembly.

The back cover is of sheet steel. The middle part is flat and the two detachable side parts or wings are trough-shiped. At the points where the trough-shaped wings touch the tunnel walls rubber flaps are attached for a tight fit.

In the lower middle part of the back cover is an opening for a box-shaped chute through which spoiling is transferred from the rotary cutting heads to the conveyor. A rubber apron is fixed at the end of the chute at the place where the spoiling drops from it onto the conveyor.

There are also openings in the middle part of the back cover for the four gear trains which are flanged onto the tubular drive shafts and whose supports are anchored in the supporting framework.

(2) Supporting Framework (Inclosures 2 and 3)

The supporting framework is of welded angle steel design. It carries the back cover, the two hydraulic motors for the rotary cutting heads, and the supports for the four gear trains.

The supporting framework is designed to be self-supporting in that it absorbs the weight of, and occurring thrusts from, the auger assembly and conducts these over the auger assembly bracing to the crawler assembly frame.

(3) Auger Assembly Gearing (Inclosure 2)

The two drive gears for the rotary cutting heads, the upper gear trains, which serve as reduction gears, are each directly flanged to an individual hydraulic motor. The transmission of power is through a pinion shaft which is fulcrumed at its shank and base. The counter flange for the hydraulic motor is at the base.

One drive gear consists of a gear with spirally-grooved gear wheels, a driving pinion, and five driven pinions for the small cutting heads.

The lower gear trains are not connected to the hydraulic motors; instead, the power is transmitted through the tubular drive shaft of each rotary cutting head.

As already noted above under subparagraph "a", the gear trains are flanged onto the tubular drive shafts.

The bearings for the tubular drive shafts are outfitted with roller bearings and with requisite lubrication fixtures.

The gear trains' housings are of welded sheet steel design. The bases of the housings are so designed that, after loosening the threaded bolts, they can be turned toward the middle of the auger assembly. This arrangement is necessary for driving the tunnel borer in reverse out of the tunnel (see Inclosure 5) because the tunnel's profile has been reduced by the permanent shorings that were installed as the tunnel was bored.

c. Upper and Lower Auger Assembly Bracing (Inclosure 3)

The auger assembly, together with the back cover, is fastened to the crawler assembly frame by means of bracing of welded tubular steel design.

The upper bracing consists of a thrust-support bracing extending from the top of the supporting framework to the middle of the crawler assembly frame. A crosspiece prevents the bracing from buckling. On each end of the thrust-support bracing is an adjustable forked connection for adjusting the horizontal boring direction.

The lower bracing consists of two V-shaped supporting struts, one for each rotary cutting head, rigidly attached to the crawler assembly frame. The struts have forked connection pieces.

The forked connection pieces on both upper and lower bracing are secured by threaded bolts to corresponding "eyes" on the supporting framework and crawler assembly frame.

d. Crawler Assembly Frame (Inclosure 2)

The crawler assembly frame carries the two track assemblies; electric motor; central hydraulic pump assembly; supporting framework; earth disposal conveyor with two roller guides; conveyor height adjustment; two oil reservoirs, and the operating panel. Further, a folding seat for the tunel borer operator is mounted below the operating panel on the crawler assembly frame.

[redacted]ded steel design, the crawler assembly frame consists [redacted] base plate at the top and two side frames. On the underside of the base plate and extending a short distance down each side frame are reinforcing ribs, which not only reinforce the base plate and form a good connection between the base plate and side frames, but also give the crawler assembly frame rigidity against torsion. The side frames are connected at the bottom by tubular crosspieces.

Two small reinforcing sheets with bore holes for taking up the track assemblies are welded onto the lower part of each side frame.

Bored holes for mounting the electric motor are in the front part of the base plate or that part nearest the auger assembly. The back part of the base plate, which carries the central hydraulic pump assembly, is raised pedestal fashion so that the electric motor and the central hydraulic pump assembly are in line and the spoiling on the slanting conveyor has clearance underneath the base plate.

A slanted plate for the operating panel is mounted at the extreme back end of the base plate.

"Eyes" for the auger assembly bracing are welded on both sides at the front and approximate middle part of the crawler assembly frame.

At the end of the crawler assembly frame farthest from the auger assembly is a non-adjustable roller guide for the conveyor. The roller guide consists of two rollers which are slightly cambered and equipped with roller bearings.

At the part of the crawler assembly frame that is nearist to the auger assembly is a roller guide of the same design as described above, but adjustable. It is mounted on an adjustable bearing which is guided on a V-way, moved by means of a spindle and led into a slot guide in the crawler assembly frame. Situated a little above the track assembly, the roller guide adjustment is easily accessible.

e. Electric Motor (Inclosure 3)

Because of the ventilation problem, an electric motor which emits no exhaust fumes was chosen in preference to a Diesel motor.

The electric motor chosen for the tunnel borer is a three-phase motor which operates at a speed of 1,480 revolutions per minute and has a rated capacity of 63 kw. It is type D 13/4 d(Sch), and was manufactured at the VEB Elektromotorenwerk in WERNIGERODE. The electric motor is protected against fire damp under protection type P33 mi.

The electric motor's housing is of welded design. The sheet-steel-covered back of the electric motor is cooled by a ventilating fan mounted on the outside. The electric motor is encased in a sealed sheet steel jacket to protect it against damage and soiling. The jacket serves also as an air channel. The armature casing can withstand an inner explosive pressure of up to 10 atmospheres. The trunnion bearing and the terminal box cover are fastened with countersunk triangular self-tapping screws. The terminal box can be turned 90° or 180°. It is equipped with a trumpet-shaped cable lead-in tube to protect the cable from damage through kinking.

f. Central Hydraulic Pump Assembly (Inclosure 3)

The hydraulic pumps have a high input and low output ratio. The required speed is attained through appropriate gearing. The gear wheels are radially serrated. Two thrust piston drives for the crawler assembly, two drives for the auger assembly, and one drive for the conveyor are flanged onto the gears. All drives are of reciprocating type, some double-row radial with built-in priming pump. The drives can be individually operated through clutch elements. All shafts rest on roller bearings. Appropriate lubrication fittings are provided.

The housing is of welded sheet steel design. It is box-shaped and mounted on a heavy base plate. The outside of the housing is ribbed from the base plate to the reinforcements.

g. Crawler Assembly (Inclos ure 2)

The crawler assembly gives the tunnel borer the motive power for forward working and for movement in both directions. Each track assembly can individually be driven forward or in reverse at a speed from zero to 2.5 m per minute. Individual drive is advantageous in changing the direction of travel.

Each track assembly is of light welded steel design and can be mounted on the right or left side. All parts of the track assembly are interchangeable. When mounted, all parts of the track assembly are easily accessible for maintenance.

The track itself is a sprocket chain with welded-on track links and with the link pins, engaged from the outside, engaging the double-sprocket wheels.

Two sprocket wheels for each track assembly are mounted onto a welded profile steel frame. Each sprocket wheel consists of two wheel disks joined by an eccentrically arranged trunnion bearing and held by concentric journal pins. In the back part of the sprocket wheel frame are guides into which the previously assembled track tightener is mounted. The track tightener is a turnbuckle-like device.

When operation is to take place on slippery terrain, additional grips can be screwed onto the track links which have holes for that purpose.

h. Conveyor (Inclosure 3)

The tunnel borer is equipped with a conveyor for disposal of spoiling cut from the tunnel face. Based on experience with different types of conveyors in various types of soil and mineral formations, a baffle-type chain conveyor with supplemental corner clearing plates was selected.

The conveyor frame is of light welded steel design. Two solid steel side plates welded to the top and bottom steel plates form a rectangular-shaped housing, which accommodates the master oil reservoir with a 182 liter capacity. The housing is reinforced on the inside by square open steel framework. The conveyor trough is formed by the two side plates jutting above the top plate. Both ends of the housing are closed by steel plates.

[redacted] end of the conveyor housing, space is provided for the drive drum with gears and hydraulic motor on one end and for the guide drum with chain tension device on the other end. The ends are reinforced by gusset stays. Wearing plates are fitted along the whole length of the top and bottom of the conveyor housing. The wearing plates extend beyond the drum shafts and are rounded at the ends to conform to the shape of the chain drums.

The drive motor for the conveyor is a radial piston motor rigidly fixed and flanged onto a bevel reduction gear. The bevel reduction gear drives a through shaft onto which the two chain drive drums are fixed. The shaft ends rest on roller bearings in the wearing plates.

The guide drum, which serves also as the chain tension device, consists of two chain drums fixed onto a through shaft. The shaft is supported by movable bearings in the wearing plates. The bearings are moved by a screw spindle. In moving the bearings, the conveyor chain is tightened or loosened.

The chain is an open link type chain. It runs along both sides of the conveyor trough and over the chain drums at either end. The chains, one on either side, are braced apart by baffles fitted into special links 30 cm apart. The baffles are reinforced against bending inward by fish-belly-shaped support.

Along the entire length on both sides of the conveyor housing, T-profile steel is welded on with the cross of the "T" flush against the sides. The conveyor is attached to the crawler assembly frame by fitting the T-channel guides into the roller guides in the crawler assembly frame.

c. Complete Hydraulic System (Inclosure 4)

The hydraulic system of the tunnel borer has five operating circuits. The drive for the two rotary cutting heads consists of two hydraulic drives operating independently in closed circuit. The crawler assembly drive consists also of two hydraulic drives operating independently in counter-pressure system. The conveyor drive consists of an individual hydraulic drive operating in open circuit without counterpressure.

(1) Hydraulic Drive for Rotary Cutting Heads

The hydraulic drive for the rotary cutting heads has two double-row radial reciprocating pumps of special design with built-in priming pumps (gear pumps) operating at a capacity of 75 liters per minute at 200 atmospheres pressure. The capacity of the pumps can be regulated from zero to the maximum capacity. Control of the oil output is imperative for infinitely variable control of the drive motors for the rotary cutting heads.

The two drive motors are also of special design. They are similar to the two pumps but cannot be regulated and have overflow pumps instead of flush pumps. The pumps can be reversed by changing the oil circulation. The rating of each hydraulic motor is a maximum of 33 hp with constant torque at reduced revolutions. There are safety valves for the operating circuits and two counterpressure valves between the oil feed line from the flush pumps to the master pumps.

There are also two three-way hand levers for thesliding valves for shifting into operation and right and left drives.

A hydraulic drive operating in closed circuit has an advantage over open circuit operation because much less oil is required. By means of the flush pump only that amount of oil which gathers through overflow of the safety valve or overflow oil or oil volume control is fed into the circuit. Another advantage of a closed circuit system is that oil hydraulic gears of high capacity operate exceedingly quitely and smoothly.

(2) Hydraulic Drive for Crawler Assembly

The hydraulic operating circuit for the track assemblies consists of two separate open circuits, one for each track assembly, which can be controlled individually. This is absolutely necessary for good steering and maneuverability in turning.

The hydraulic equipment consists of two specially-designed radial receiprocating pumps with flange connection which have a capacity of 38 liters per minute at 200 atmospheres pressure. The capacity can be regulated. The hydraulic equipment consists further of four oil pressure cylinders for the thrust piston drive. Two oil pressure cylinders for each track assembly are anchored by their piston rods onto the eccentrically-arranged trunnion bearings of the two sprocket wheels. The cylinder ends are attached swivelably in the track assembly frame. There are also four automatic reversing sliding valves, two for each track assembly or one for each oil hydraulic or pressure cylinder. The hydraulic equipment further includes two three-position hand levers for stopping, and forward and reverse driving of the individual track assemblies. The two safety valves installed in the oil pressure lines protect the hydraulic system against overloading, and the counterpressure valves installed in the oil return lines maintain the pressure for the counterpressure system.

(3) Hydraulic Drive for Conveyor

The hydraulic drive for the conveyor operates without counterpressure and is shifted in open circuit. The hydraulic equipment consists of a specially-designed radial reciprocating pump with flanged drive motor with a capacity of 38 liters per minute at 80 atmospheres pressure. The flow of the pump can be regulated from zero to the maximum capacity. The flanged hydraulic drive motor is also of special design with built-in planetary gear. The motor cannot be regulated but can be reversed by changing the pressure system. The maximum capacity of the drive motor is approximately 6.8 hp. A safety valve is built in to protect the hydraulic system from overloading. The oil return functions without pressure.

(4) Information Applicable to Aforementioned Hydraulic Drives

All oil lines are nonflexibly installed with hose connections at movable parts. Separating stop valves are installed at separation points of the hydraulic lines to prevent loss of oil and entrance of air into the hydraulic lines.

The revolutions of the pumps are regulated by attached screw spindles with handwheels for minute regulation. Automatic regulation of all the hydraulic drives is assured through the installation of volume regulators. With appropriate equipment, the tunnel borer can be operated by remote control.

[redacted] to provide sufficient oil for the hydraulic system, the tunnel borer [redacted] with three oil reservoirs which are interconnected [redacted] a total capacity of 318 liters. An oil reservoir with 96-liter capacity is mounted in the supporting framework. A reservoir with 40-liter capacity is mounted in the crawler assembly frame. The master oil reservoir with 182-liter capacity is mounted in the conveyor housing.

3. Employment of the Tunnel Borer

Once at the tunnel site, the electric motor is turned on and the tunnel borer is brought into position. The tunnel borer is brought into position by shifting the track assembly pumps into operation. After the pumps are operating, they are shifted by means of the handwheels from zero to the desired performance, and the two three-position hand levers for the right and left track assemblies are shifted into forward position. The required speed and driving direction are regulated by means of the handwheels and, according to necessity, by shifting the hand levers into other positions.

After the tunnel borer has been brought into position, the pumps for the rotary cutting heads and the conveyor are shifted into operation in the same procedure as described above. Now the forward movement of the cutting operation must be adjusted. This is done according to the type and condition of the earth formation about to be cut.

If it is necessary to cut at an incline or decline, the rotary cutting heads must be set in the appropriate position. This is done by adjusting the supporting framework bracing by loosening and resetting the threaded bolts so that the rotary cutting heads tilt backward or foreward as the case may be.

If the cutting direction is to be changed horizontally, it is necessary to change the speed of one track assembly and to reduce the speed of one of the rotary cutting heads.

As noted above under subparagraph "a", the material loosened by the rotary cutting heads is thrust onto the conveyor by the upward thrust of the sole part and the downward thrust of the intermediate and head parts of the rotary cutting heads. The greater part of the spoilings falls under its own weight onto the conveyor. From the conveyor, the spoiling can be transported out of the tunnel by various methods as described in a following paragraph.

According to the type of soil and the ceiling pressure, the length of the cutting stages into the tunnel is determined. On the average a cutting stage is from 45 to 75 cm in length. After each stage is cut, the walls and ceiling of the tunnel is appropriately shored to prevent a cave-in.

As the tunnel borer works its way forward into the next stage, the walls and ceiling are temporarily shored with a frame of U-girders. Between the U-girder frame and the walls and ceiling, low grade lumber in a length appropriate to the driven stage is pushed to give better support. Thus temporary shoring is placed only the length of the tunnel borer itself. As it cuts its way into the next stage, the immediately previously opened stage is removed of its temporary shoring and is permanently shored.

For permanent shoring, wood planks, 10 x 20 cm in size and in the length of the driven stage, are used. The ceiling and wall planks are fastened together with metal fixtures. The floor planks are also held by metal fixtures.

After the desired length of the tunnel has been reached, the lower bracing of the auger assembly is loosened, the conveyor is pulled back, and the crawler assembly is driven slowly in reverse. If the tunnel ceiling does not cave in, the rotary cutting heads can be slowly run to cut themselves free as the tunnel borer moves backward.

Once the tunnel borer has been backed out of the final stage of the tunnel, the upper bracing of the auger assembly is bolted to the "eyes" for the lower bracing. The base screws of the four gear trains are loosened and the rotary cutting heads are pushed toward the middle until they come to rest on a stop provided for this purpose. The back cover of the auger assembly with its trough-shaped wings is pushed upward. Now the tunnel borer can be driven in reverse out of the tunnel. (See Inclosure 5.)

When the tunnel borer is backing out of the tunnel, the auger assembly, which is suspended by the upper bracing, rests on skids mounted on the supporting framework. Other than removal of the four bolts on the lower bracing, only the hose to the oil reservoir in the supporting framework need be disconnected.

The operation of driving the tunnel borer out of a tunnel is analogous to driving it into a tunnel. The tunnel borer is easy to operate and can be learned in a short time by one who has a certain amount of imagination and aptitude.

Direction finding or maintaining the correct direction while cutting a tunnel, as far as it is necessary, is done by means of a ray of light, the source of which is installed in true direction under the tunnel ceiling. The ray of light shines on a cross-thread-type sighting device mounted on the tunnel borer. By this method a deviation in direction becomes immediately apparent.

4. Various Methods for Disposal of Spoilings

a. Baffle-type Chain Conveyor

The best method for disposing spoilings in all types of soil proved to be the baffle-type chain conveyor described above. This type of conveyor was designed to be laid in sections, 4 to 5 m in length, which are placed together in overlapping fashion, forming a conveyor unit 25 to 30 m in length. Each conveyor section is complete in itself.

With a baffle-type chain conveyor, spoiling with a high water content can be disposed of without the use of pumps because the conveyor trough carries the water together with the spoiling. The spoiling serves to make the conveyor trough watertight. Through the special design of the drive and guide drums, the chain links are cleaned and the spoiling is prevented from agglomerating. The special corner clearing plates keep the corners cleared and prevent the conveyor chain from climbing.

The proven advantages of the baffle-type chain conveyor over a rubber belt conveyor are the operational reliability and the ease in setting up in overlapping manner a conveyor 25 to 30 m in length.

[redacted]le-type Chain Conveyor with Water Flushing Equipment

Another method for disposing spoilings, provided sufficient water is available, is the following already tried method.

Two sections of the above-described baffle-type chain conveyor are placed in overlapping fashion behind the tunnel borer. At its free end the second conveyor section is above a mixing funnel with a 75 mm sieve in the top. From the conveyor the spoiling drops onto the sieve and, by spiral-shaped water spraying nozzles, is washed into the mixing funnel. The spoiling is mixed with the water and is pumped out of the funnel by a sludge pump through a 150 mm diameter pipe line out of the tunnel. In order to keep the tunnel floor clear, the pipe line is mounted underneath the tunnel ceiling.

With the aforementioned method, spoilings can be cleared out of a tunnel up to 25 m in length without necessitating alterations on the disposal equipment.

c. Rubber Belt Conveyor

A third method for disposing spoilings is by rubber belt conveyors laid in overlapping fashion. This is the best way to connect conveyors because the conveyor sections can be carried and can quickly be put in place.

Experience has shown that rubber belt conveyors can be used only where the earth is not slimy or sticky. Otherwise, the earth will adhere to the conveyor drums and will cause the belts to slip off or tear. Drum cleaning blades are of no help because they become bent or break off.

The only way to clean slimy, sticky earth from conveyor drums is to play large amounts of water on them. But the disadvantage in doing this is that the tunnel bloor becomes very wet and slippery and the earth becomes swollen. These conditions must be avoided in underground workings.

d. Other Methods for Spoiling Disposal

Other methods for disposing spoiling is by flattening it on the tunnel floor or by floating it out of the tunnel in ditches along the sides of the tunnel.

The most primitive method for disposing spoiling is by wheelbarrow. This method can be used in short tunnels, but is very slow.

5. Materials used in the Tunnel Borer

In order to keep the weight of the tunnel borer to a minimum, steels of high tensile strength were used.

Electrodes of type Kb 52 were used for welding. All welded seams were X-ray checked.

St 50.22 type steel with a tensile strength of 50 to 60 kg mm^2 was used for the crawler assembly frame, track assemblies, conveyor frame and central hydraulic pump assembly housing. The composition of St 50.22 steel is: Carbon, 0.33%; silicon, 0.26%; manganese, 0.65%; phosphorous, maximum of 0.050%, and sulphur, maximum of 0.055%

For the rotary cutting head blades, auger back cover, supporting framework, and the gear train housings, St 60.22 type steel with a tensile strength of 60 to 70 kg mm^2 was used. The composition of this type of steel is: Carbon, 0.55%; silicon, 0.26%; manganese, 0.65%; phosphorous, maximum of 0.050%, and sulphur, maximum of 0.055%.

St 55.29 type steel with a tensile strength of 55 to 70 kg mm^2 was used for the upper and lower auger bracing. The composition of this type of steel is: Carbon, 0.32%; silicon, 0.17%; manganese, 0.50%; phosphorous, maximum of 0.040%; sulphur, maximum of 0.045%.

Casehardened high alloy steels with appropriate tensile strengths were used for the gears, shafts, sprocket wheels, chain drums, and conveyor chain. The piston rods of the oil pressure cylinders and the pump pistons are hard- chromium plated.

COMMENTS

50X1-HUM

THIS IS RAW, UNEVALUATED INFORMATION.

Inclosures

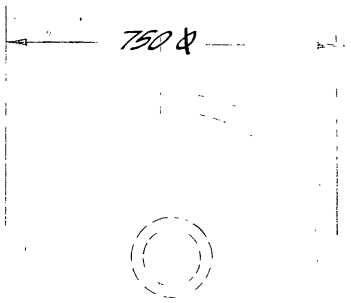
1. Side and Top View of Complete Tunnel Borer (C) CONFIDENTIAL
2. Details of Ratary Cutting Head, Auger Back Cover, and Crawler Assembly(U) CONFIDENTIAL
3. Details of Conveyor, Bracings, Electric Motor, and Central Hydraulic Pump Assembly (U) CONFIDENTIAL
4. Complete Hydraulic System (U) CONFIDENTIAL
5. Sketch of Position for Backing out of Tunnel (C) CONFIDENTIAL
6. Microfilms, Inclosures 1-5 (U)(for DA and G2 USAREUR, only)CONFIDENTIAL

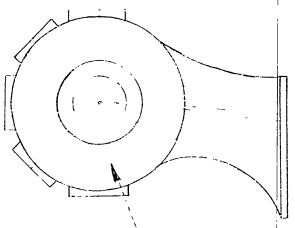
CONFIDENTIAL

Tunnel Borer for the E

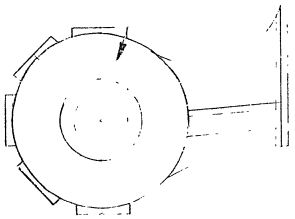
Inclosure 2

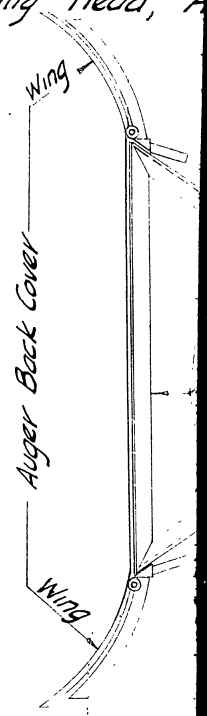
Details of Rotary Cutting Head, A





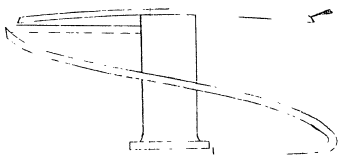
Rotary Cutting Head
Gear Train, Left & Right





Auger Back C
Supporting, P

Rotary Cutting Head, Head Part

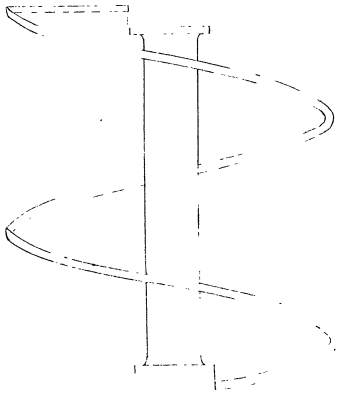


Tunnel Ceiling Cave-in
Prevention Plate

Upper Gear Train

Hydraulic Motor

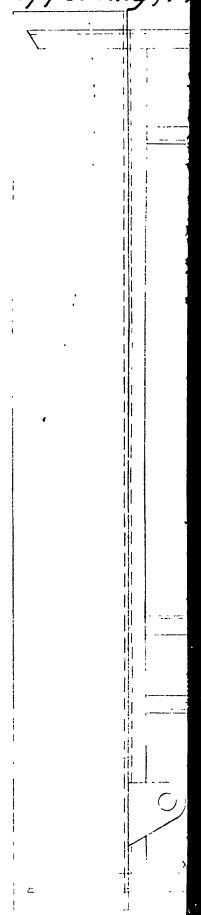
Rotary Cutting Head
Intermediate Part



Small Cutting Heads

Lower Gear Train

Rotary Cutting Head
Sole Part



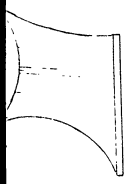
Scale 1:10
All Dimensions are in Millimeters

CONF

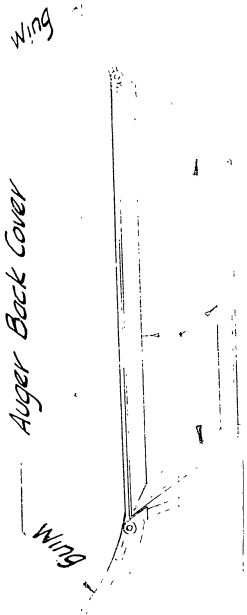
Tunnel Borer for the East German Army

Inclosure 2

etails of Rotary Cutting Head, Auger Back Cover & Crawler Assen

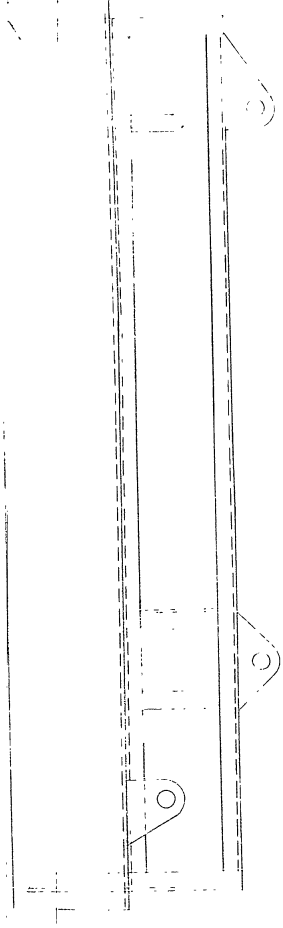


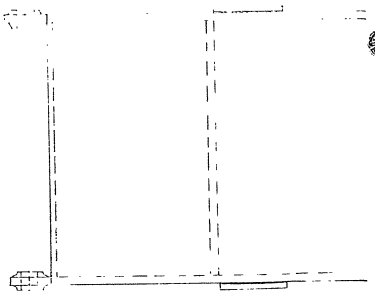
Rotary Cutting Head
Gear Train, Left & Right



Supporting
Framework

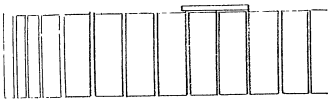
Auger Back Cover with
Supporting, Framework



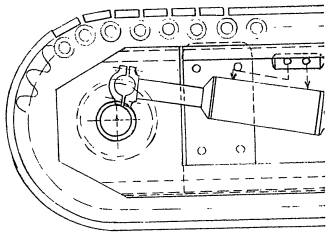


Crawler A

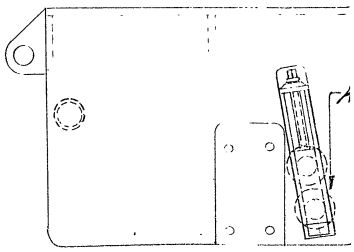
Tr



Track Assem



Crawler Assemb



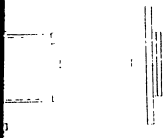
uling Cave-in
Plate

ar Train

Hydraulic Motor

Small Cutting Heads

ear Train



1:10
mensions are in Millimeters

CONFIDENTIAL

erman Army

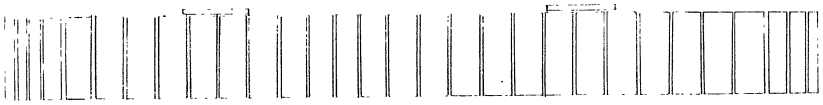
50X1-HUM

Back Cover & Crawler Assembly

Crawler Assembly Frame. Top View

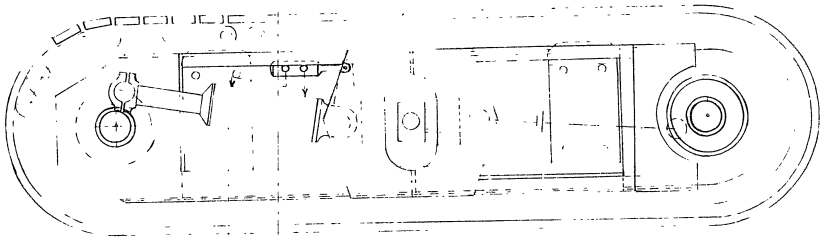
upporting
ramework

Track, Top View



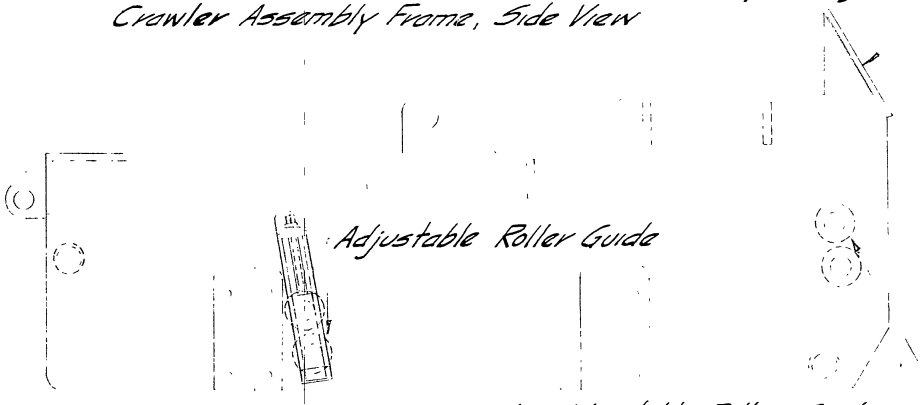
with
rk

Track Assembly with Thrust Piston Drive



Operating Panel →

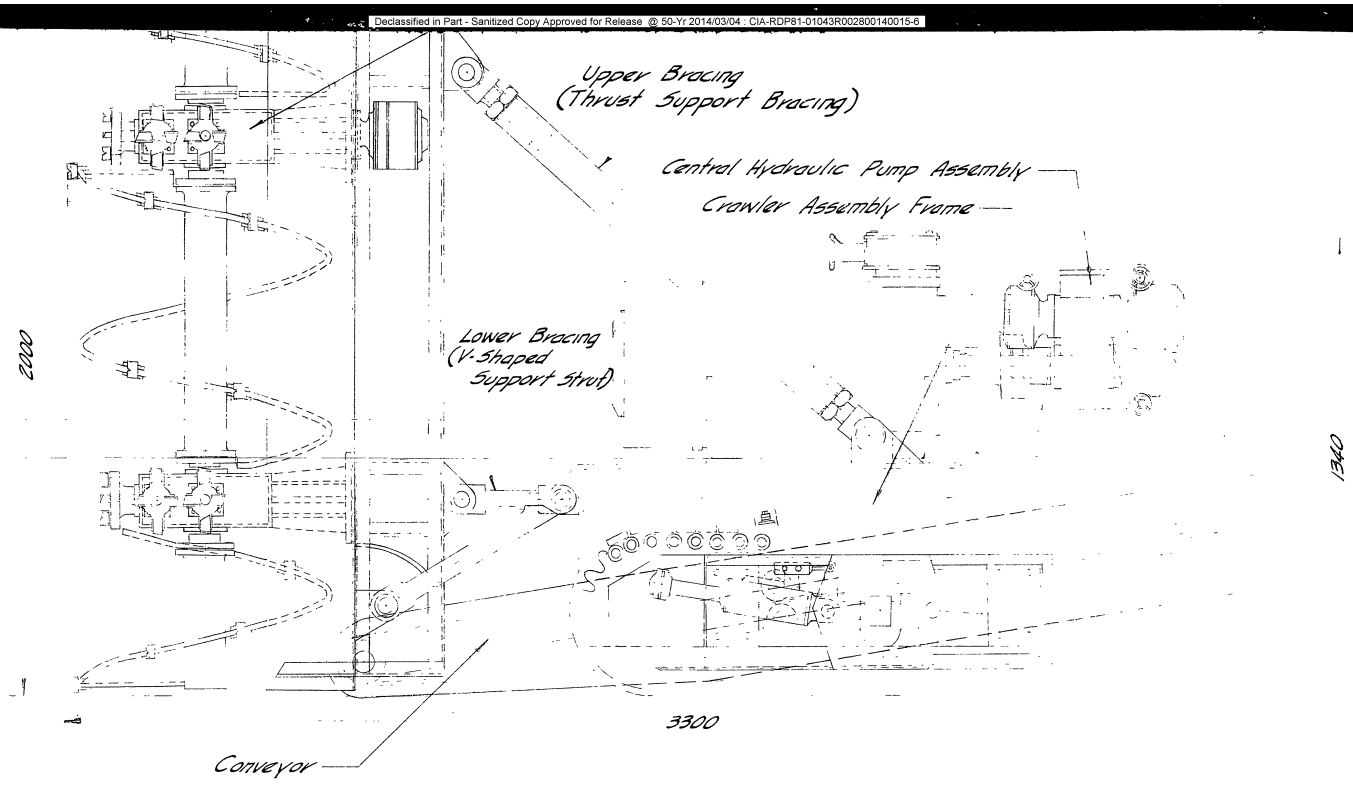
Crawler Assembly Frame, Side View



Adjustable Roller Guide

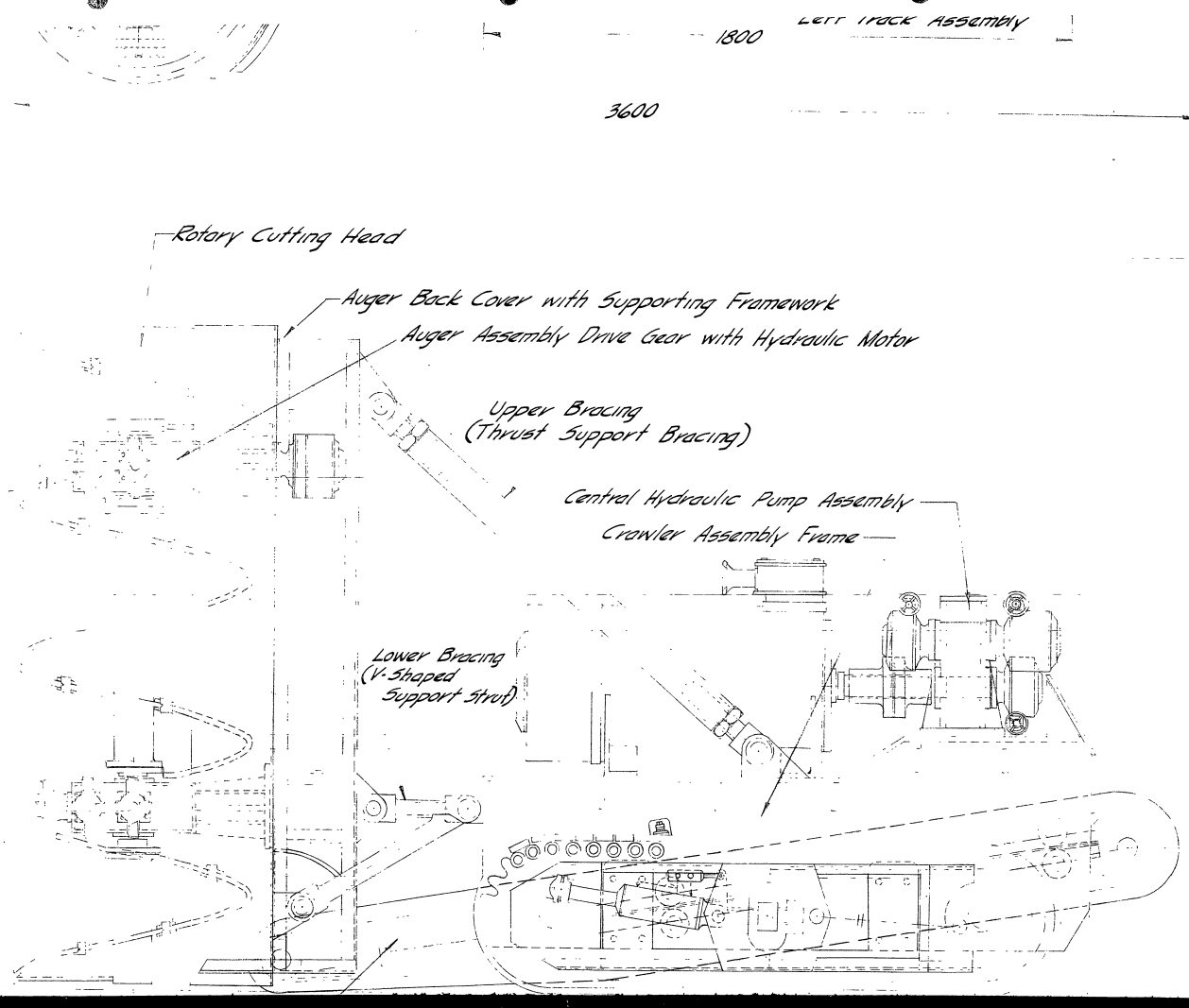
Non-Adjustable Roller Guide

TIAL



Scale 1:10
All Dimensions are in Millimeters

CONFIDENTIAL



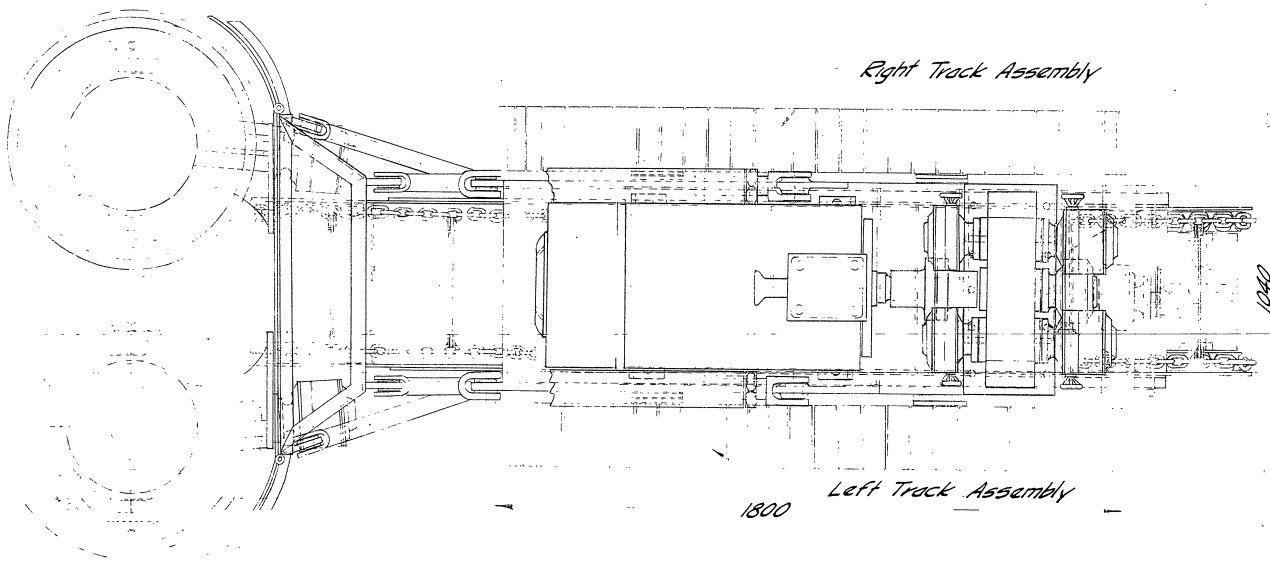
50X1-HUM

CONFIDENTIAL

Tunnel Borer for the East German Army

Inclosure 1

Side and Top Views of Complete Tunnel Borer



CONFIDENTIAL

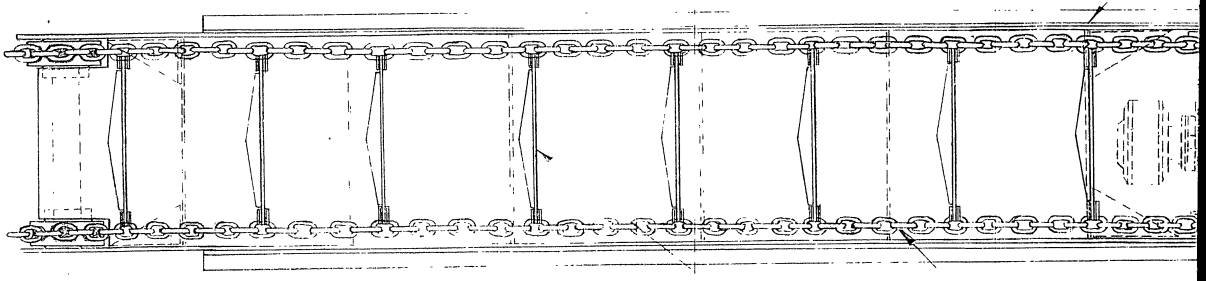
Tunnel Borer for the

Inclos

Details of Conveyor, Bracings,

Baffle-type Chain Conveyor, Top View

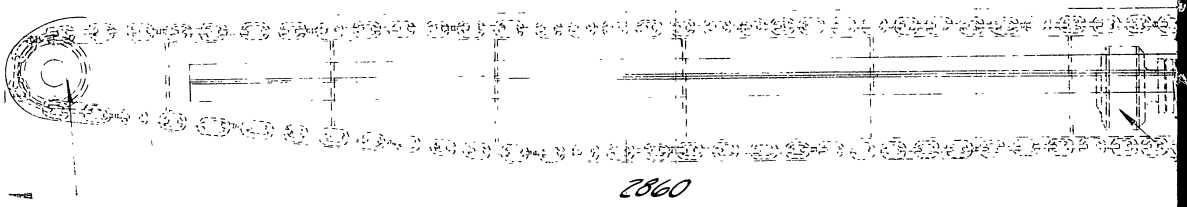
T-



Baffle

Open Link Cha

Baffle-type Chain Conveyor, Side View

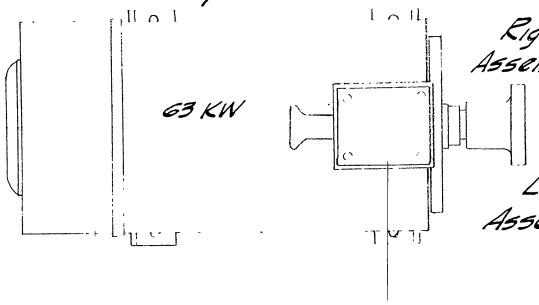


2860

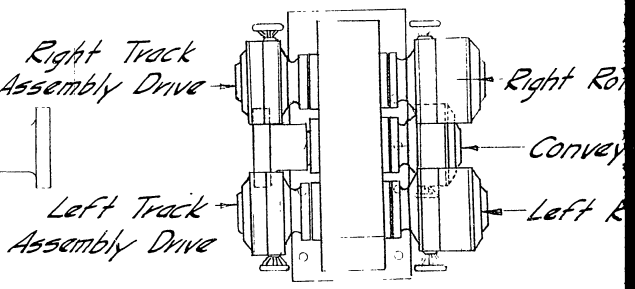
Guide Drum and Chain Tension Device

Hydraulic Motor & Drive D

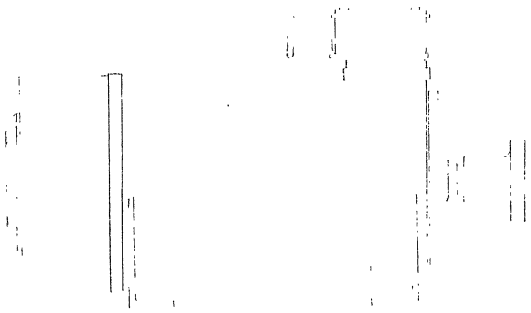
Fire Damp Protected Electric Motor, Top View



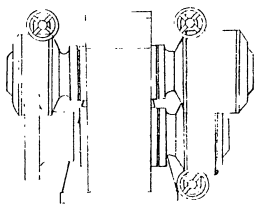
Central Hydraulic Pump Assembly,



Fire Damp Protected Electric Motor, Side View



Central Hydraulic Pump Assembly, Side View



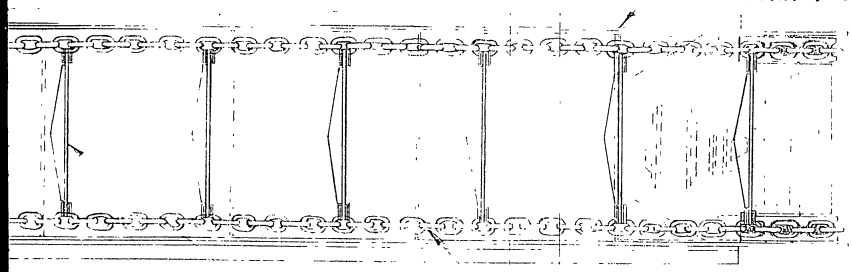
CONFI

Tunnel Borer for the East German Army

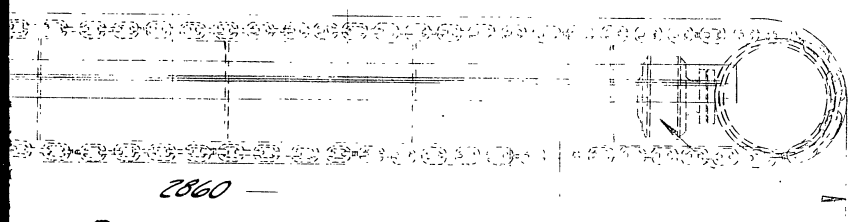
Inclosure 3

Details of Conveyor, Bracings, Electric Motor, and Central Hydra

-type Chain Conveyor, Top View

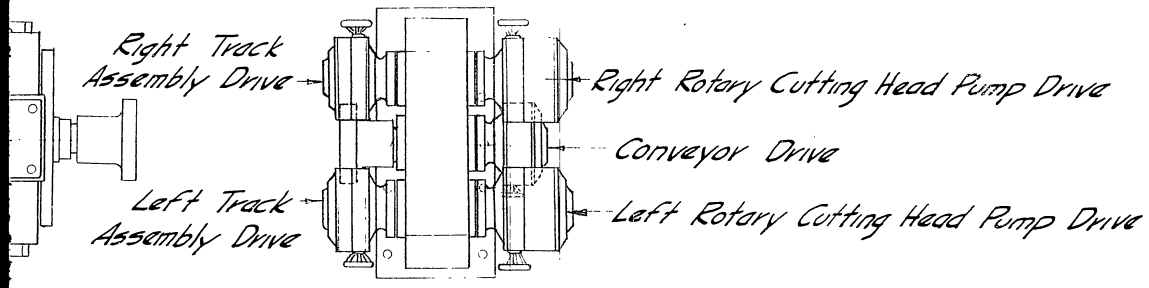


-type Chain Conveyor, Side View

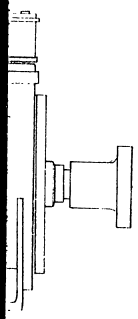


or,

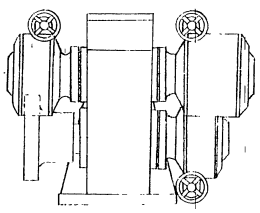
Central Hydraulic Pump Assembly, Top View



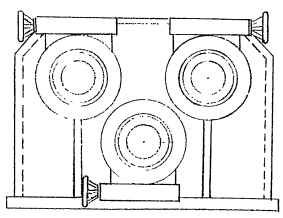
or, Side View



Central Hydraulic Pump Assembly, Side View



Central Hydraulic Pump Assembly, Front View



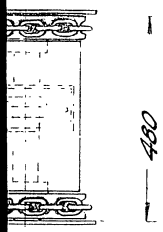
CONFIDENTIAL

East German Army

e 3

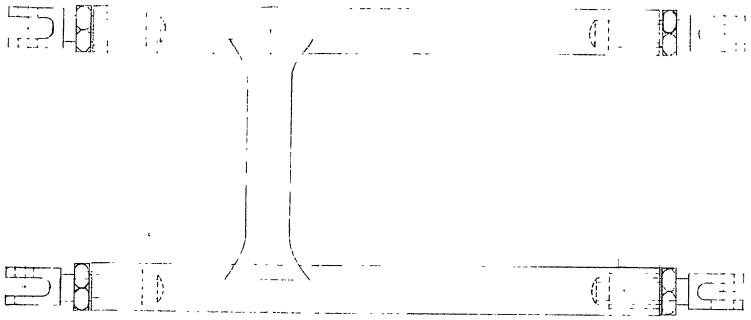
Electric Motor, and Central Hydraulic Pump Assembly

annel Guide

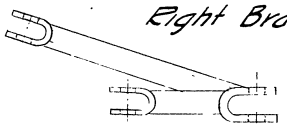


480

Auger Assembly Upper Bracing



Right Bracing



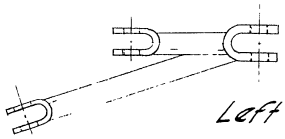
View

Auger Assembly Lower Bracing

Cutting Head Pump Drive

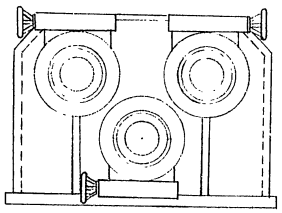
Drive

y Cutting Head Pump Drive

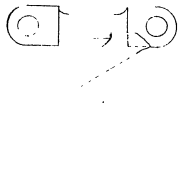


Left Bracing

Central Hydraulic Pump
Assembly, Front View



Lower Bracing, Side View



ITIAL

Scale 1:10

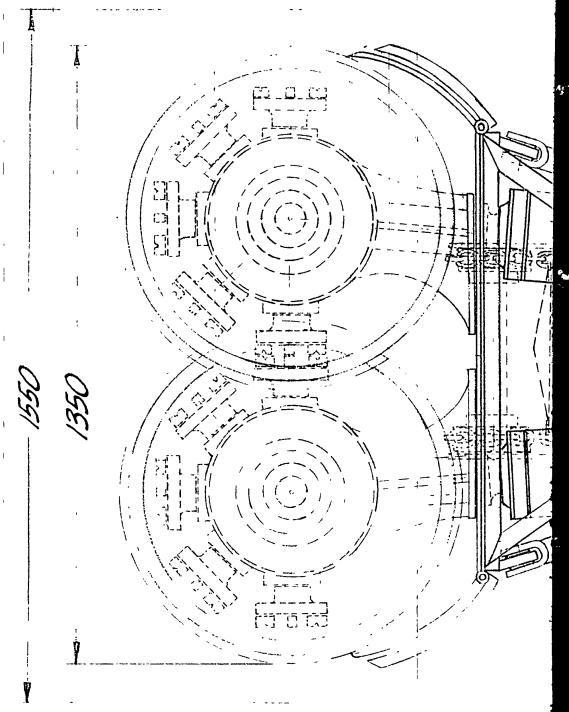
All Dimensions are in Millimeter

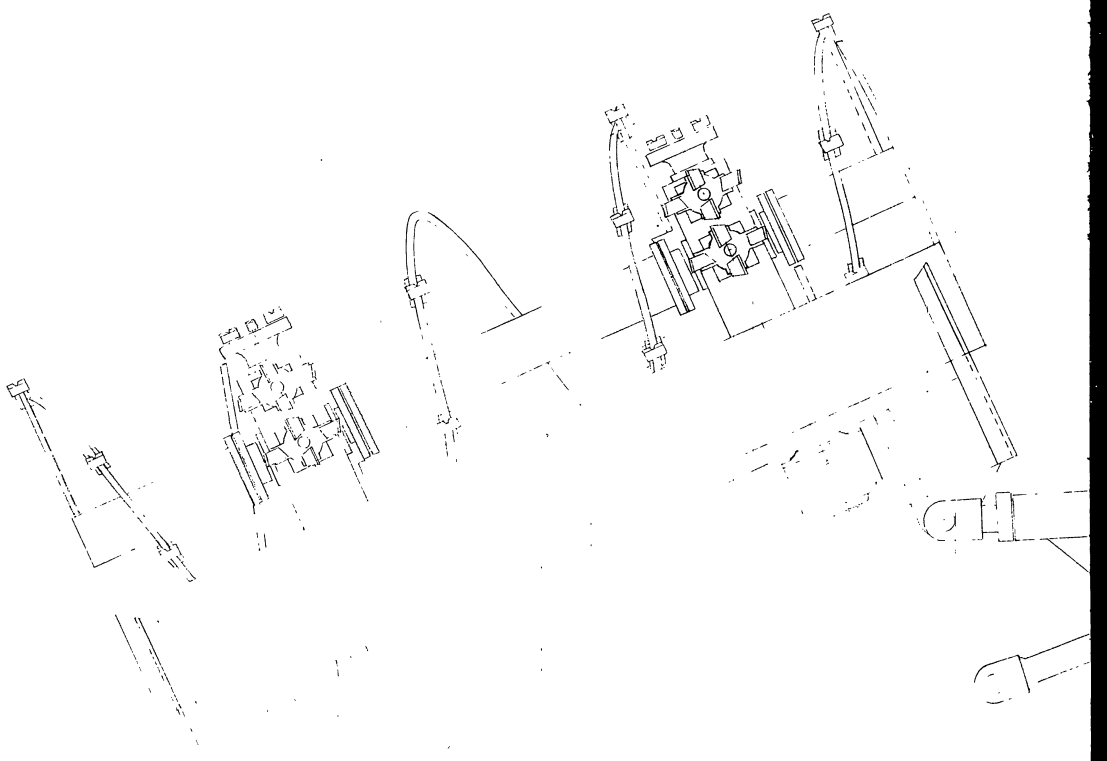
CONFIDENTIAL

Tunnel Borer for the

Inclosure

Sketch of Position for





Skids

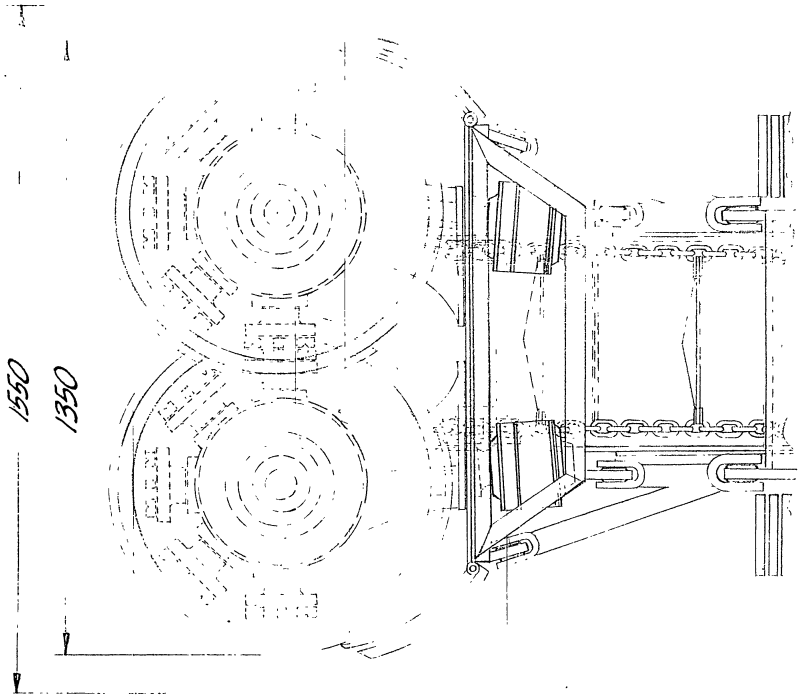
Scale 1:10
All Dimensions are in Millimeters

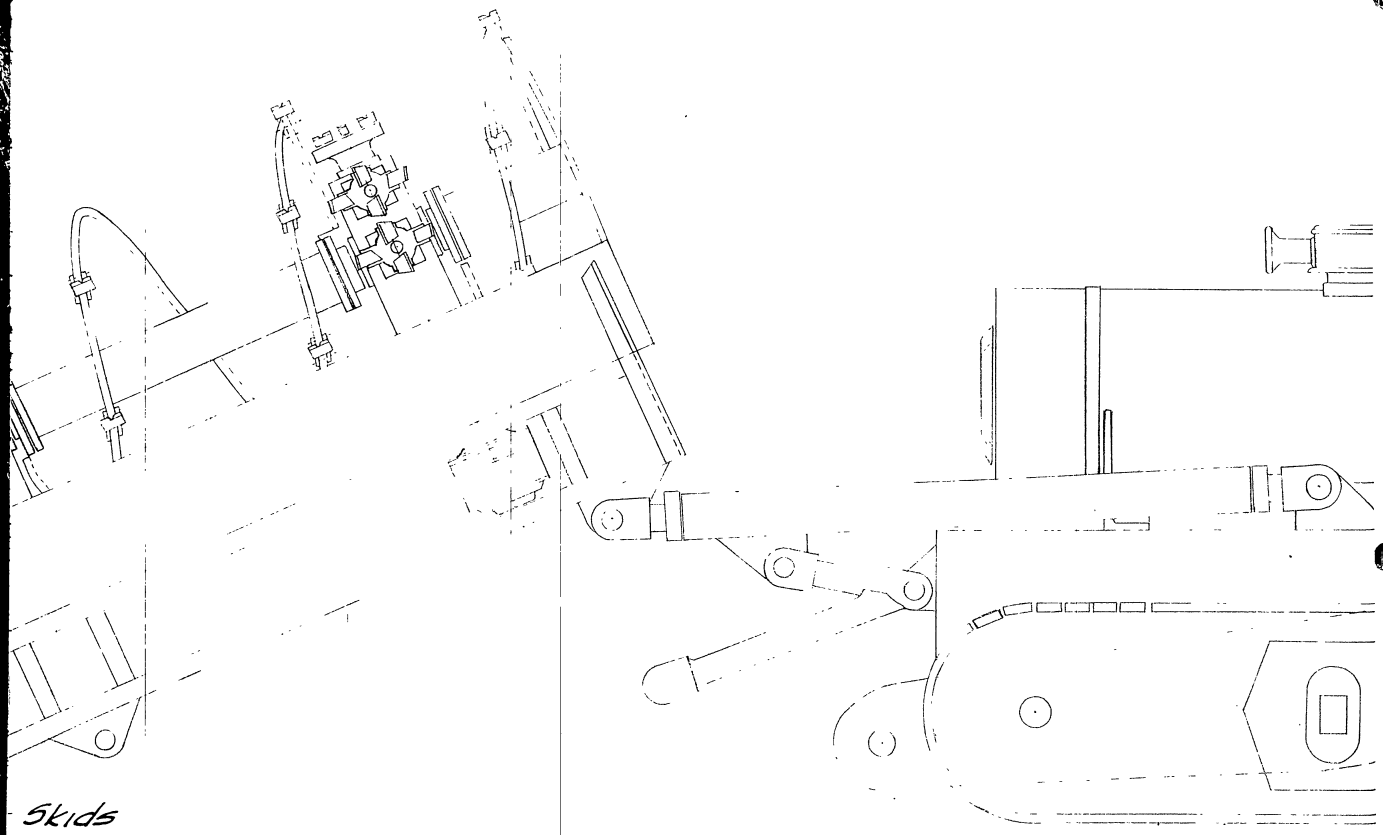
CONFIDENT

Tunnel Borer for the East German Army

Inclosure 5

Sketch of Position for Backing Out of Tunnel





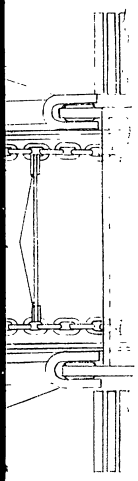
Skids

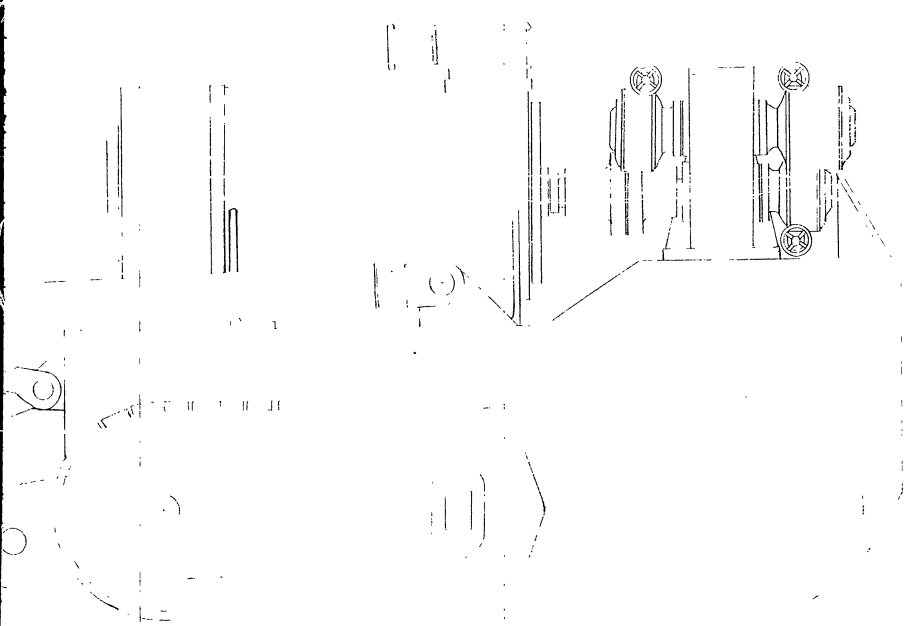
ters

CONFIDENTIAL

German Army

ng Out of Tunnel





[redacted]

50X1-HUM

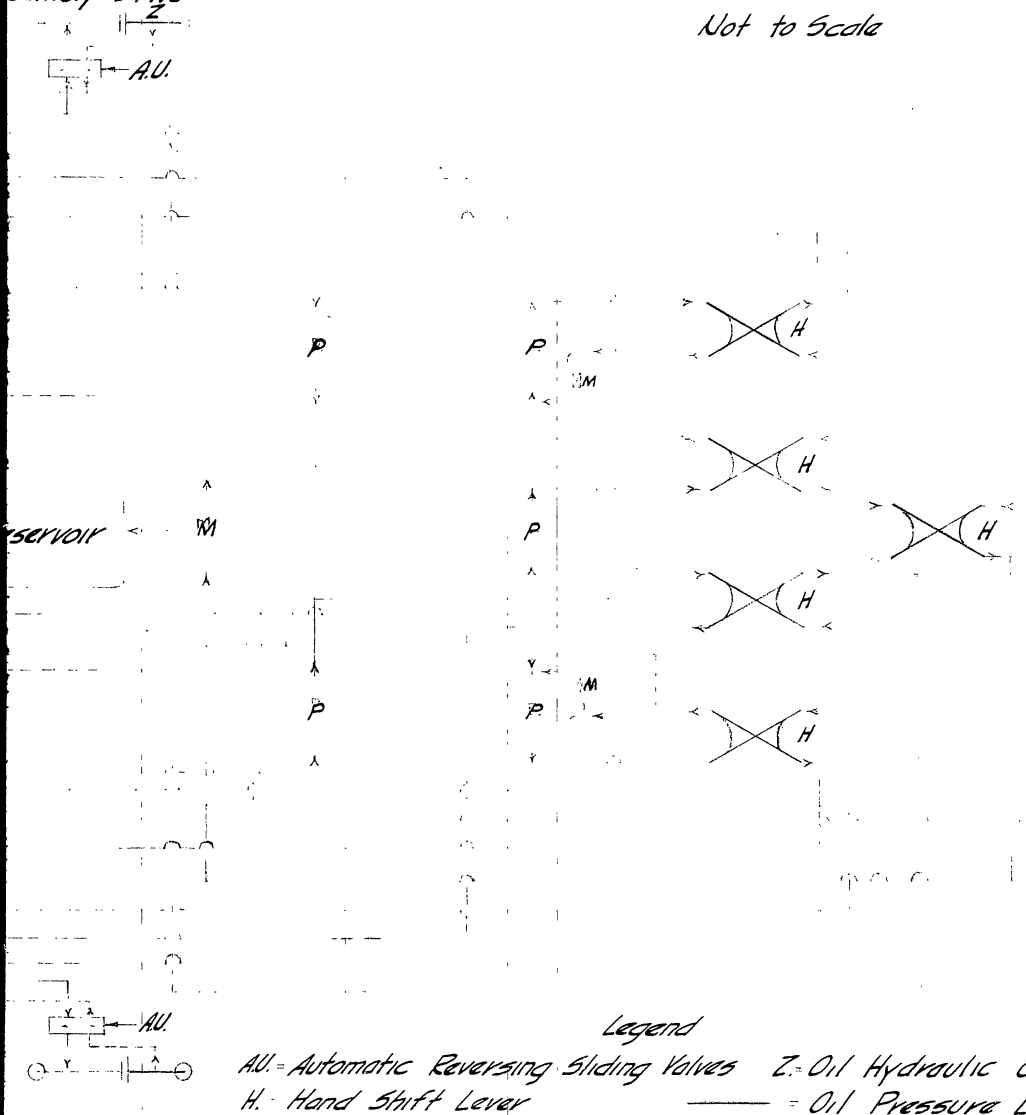
for the East German Army

Inclosure 4

mplete Hydraulic System

sembly Drive

Not to Scale



Legend

A.U. = Automatic Reversing Sliding Valves
H. = Hand Shift Lever
M. = Hydraulic Motor
P. = Hydraulic Pump
Z. = Oil Hydraulic Cylinder
——— = Oil Pressure Line
– – – – = Oil Return Line
—·——·— = Oil Suction Line

bly Drive

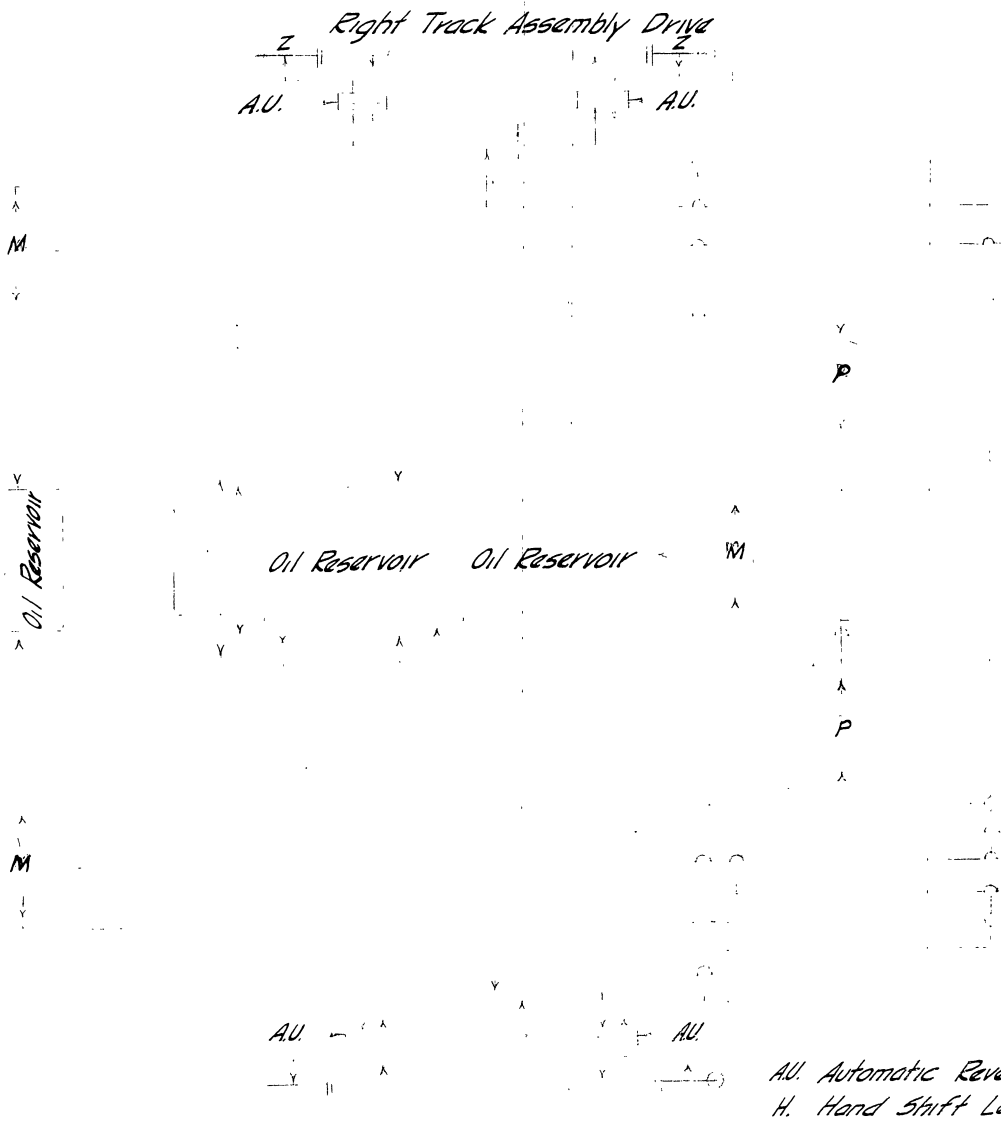
CONFIDENTIAL

CONFIDENTIAL

Tunnel Borer for the East German Arm

Inclosure 4

Complete Hydraulic System



CONFIDENTIAL